

IN THE SPECIFICATION

B2 [0035] FIG. 3A illustrates a high aspect ratio via containing an oxidized 300 copper underlayer 305 prior to preclean. FIG. 3B shows a high aspect ratio via showing sidewall redeposition 320 of the sputtered copper oxide 300 removed from the bottom of the via and tapering of the via corners 315 due to excessive argon ion 177 sputtering (illustrating the issues associated with problems in the prior art). FIG. 3C shows a high aspect ratio via showing the present invention whereby the copper oxide 300 has been removed without sidewall redeposition 320 and without adverse tapering of the via corners 325. This same process can also remove carbonaceous impurities left behind during the etching of the vias (either along the sides or bottoms of the vias). Subsequent deposition of a barrier layer (e.g., Ta, TaN_x, etc.) via the introduction of a suitable tantalum containing precursor (e.g., TaCl₅, TaBr₅, etc.) can be performed via MII-ALD. The same atomic hydrogen 176 is now used as the reducing agent to form metallic Ta and byproducts (e.g., HCl or HBr), which can be readily pumped 184 away.